II. *Obſervations on the Growth of Trees: By* Robert Marſham, *of* Stratton *in* Norfolk, *Eſq; communicated by the Rev.* Steph. Hales, *D. D. F. R. S.*

Meaſures of Trees, taken in April 1743, *before they began to ſhoot; and again in Autumn* 1758, *after the Year's Growth was completed. The Meaſure taken at 5 Feet from the Earth.*

FIRST TABLE.

Read Jan. 11, 1759.

	Circumf. in Spring 1743.			Circumf. in Autumn 1758.			Increaſe in 16 years.			Content in 1743.			Content in 1758.			Solid increaſe in 16 years.		
	Feet.	Inches.	8ths of In.	Feet.	Inches.	8ths of In.	Feet.	Inches.	8ths of In.	Cubic feet.	Quarters.	Inches.	Cubic feet.	Quarters.	Inches.	Cubic feet.	Quarters.	Inches.
1. Aſh, planted ſince 1647 — —	9	10	4	11	1	0	1	2	4	60	1	318	76	3	43	16	1	157
2. Oak, paſt thriving, but found — —	9	4	4	10	1	0	0	8	4	54	1	336	63	2	80	9	0	176
3. Oak, about 80 years old — —	6	3	3	7	8	3	1	5	0	24	1	284	36	2	408	12	1	124
4. Scotch Fir, ſeed in 1698 — —	5	4	6	6	6	0	1	1	2	17	3	48	26	1	270	8	2	222
5. Oak, planted above 60 years — —	5	11	1	7	2	3	1	3	2	21	3	224	32	0	174	10	0	382
6. Spaniſh Cheſnut, near 60 years old	4	4	0	5	6	3	1	2	3	11	2	408	18	3	270	7	0	294
7. Another, 45 or 46 years old — —	2	9	6	4	4	4	1	6	6	4	2	391	11	2	408	7	0	17
8. Oak, planted by me in 1720 — —	2	11	2	5	1	2	2	2	0	5	1	116	16	0	260	10	3	144
9. Scotch Fir, planted 1734, 2 feet high	1	11	6	4	0	0	2	0	2	2	2	0	10	0	0	7	2	0
10. Pinaſter, planted in 1734 or 1735	2	5	1	4	3	1	1	10	0	3	2	260	11	1	68	7	2	240
11. Oak, ſet an acorn in ſpring 1719 —	1	7	0	2	8	2	1	1	2	1	2	116	4	1	336	2	3	220
12. Oak, planted in 1720 or 1721 ——	2	9	5	4	9	4	1	11	7	4	2	391	14	0	176	9	1	217
										213	0	300	322	0	333	109	0	33

Now

Now as the twelve trees above, contained 213 cubic feet 300 inches of timber in ſpring 1743, and have increaſed to 322 cubic feet 333 inches in autumn 1758; that is, 109 cubic feet 33 inches in 16 years growth; if all the trees were of the ſame kind, 109 feet pays 3 *per cent.* for ſtanding: and the ſix oaks pay near the ſame intereſt, although one of them, N° 2. appeared paſt thriving in 1743; for the increaſe of the ſix oaks is from 112 feet 1 quarter 171 inches of timber, to 167 feet 138 inches, *i. e.* 54 feet 2 quarters 399 inches; which is above 3 *per cent.* But if you take only the five thriving oaks, then their content is, from 57 feet 3 quarters 267 inches, to 103 feet 2 quarters 58 inches; *i. e.* 45 feet 2 quarters 223 inches of timber; or near 5 *per cent.* And the increaſe of the moſt thriving oak, N° 8. appears, by the above table, to pay above 12 ½ *per cent.* and the Scotch fir, N° 9. being under 2 feet and half of timber in ſpring 1743, and 10 feet in autumn 1758, pays above 18 ¾ *per cent.* Beſides it ſhould be conſidered, altho' I meaſured the largeſt and moſt thriving oak and Scotch fir in 1743, yet ſeveral others of the ſame age, both oaks and Scotch firs, have greatly exceeded the meaſured trees for many years paſt; *e. g.* the oak N° 11. appears by the table two feet 8 inches 2-8ths in circumference; and another juſt by it is 2 feet 11 inches 6-8ths; and an oak tranſplanted from this grove, is 3 feet 9 inches 5-8ths round; yet this laſt tree was conſiderably leſs than the firſt when removed, and not planted in a better ſoil, and yet is 1 foot 1 inch 3-8ths larger than the original tree. The firſt contains 4 feet 1 quarter 336 inches, and has gained 2 feet 3 quarters 220 inches

inches in ſixteen years: the laſt contains 8 feet 3 quarters 68 inches; and, ſuppoſing them equal in 1743, gains 7 feet 384 inches; *i. e.* above 2 ½ the increaſe of the firſt tree. But notwithſtanding the tranſplanted oak is thus much larger than the original oaks in the grove, yet as the tranſplanted tree does not run half the height of the trees in the grove before it heads, they differ but little in their quantity of timber.

The following table ſhews the monthly increaſe of trees in the years 1757 and 1758. As I endeavoured to take the meaſures with as much exactneſs as was in my power, I cut three, four, or more notches in the bark of each tree, that my line might always be confined exactly to the ſame place. I obſerved, if I meaſured ſoon after a rain, whilſt the bark was ſaturate with water, the tree would be $\frac{1}{8}$ of an inch larger than after a day or two of dry weather. I may here add, that all the meaſures of circumferences of trees are taken at 5 feet from the earth: and conſequently the ſolid meaſures muſt include 10 feet in length. I generally made uſe of Keay's Tables in the ſolid meaſures, which go no lower than quarters of inches in girts: which is not ſo exact as it ought to be.

Meaſures of the monthly Increaſe of the moſt thriving Trees I had, of the following ſeveral Kinds, taken at 5 Feet from the Ground in the Years 1757 and 1758.

TABLE II.

	Feet.	Inches.	8ths of In.	1 June 1757.	3 July 1757.	3 Aug. 1757.	4 Sept. 1757.	Nov. 1757.	1 June 1758.	30 June 1758.	31 July 1758.	29 Aug. 1758.	29 Sept. 1758.
1. An Oak planted in 1720, No. 8. in the other table — — —	4	9	7	4 10 1	4 10 3	4 10 7	4 11 2	4 11 2	4 11 3	4 11 6	5 0 4	5 1 2	5 1 2
2. A Beech, a ſeed in 1741 — — —	0	11	0	0 11 1	0 11 5	1 0 1	1 0 4	1 0 4	1 0 7	1 1 3	1 1 7	1 2 2	1 2 3
3. A Scoth Fir, planted in 1734. about 2 feet high — — —	4	2	4	4 3 0	4 3 1	4 3 2	4 3 4	4 3 6	4 4 1	4 4 3	4 4 4	4 4 6	4 4 6
4. An Oak, an acorn in ſpring 1719. never removed — — —	2	9	4	2 9 5	2 9 6	2 10 1	2 10 2	2 10 2	2 10 4	2 10 6	2 11 1	2 11 5	2 11 6
5. A Spaniſh Cheſnut 45 or 46 years old, No. 7. in the other table — —	4	2	5	4 2 7	4 3 0	4 3 1	4 3 4	4 3 4	4 3 4	4 3 5	4 4 1	4 4 4	4 4 4
6. An Elm, about 25 years old —	1	7	0	1 7 4	1 8 0	1 8 2	1 8 4	1 8 4	1 9 0	1 9 4	1 9 7	1 10 2	1 10 3
7. A Spruce Fir, planted in 1735. about 2 feet high — — —	-	-	-	- - -	- - -	- - -	3 6 1	3 6 2	3 7 0	3 7 1	3 7 4	3 8 0	3 8 0
8. A Larch, planted in 1749 — — —	1	0	7	1 1 5	1 2 2	1 2 5	1 2 7	1 3 1	1 3 6	1 4 3	1 4 6	1 5 1	1 5 1
9. A Willow, ſet in ſpring 1756 — — —	-	-	-	- - -	5 1 7	5 2 2	5 2 3	5 2 3	5 2 3	5 3 0	5 3 7	5 4 2	5 4 3
10. A Beech, a ſeed in 1733 — — —	-	-	-	- - -	- - -	- - -	- - -	1 10 4	1 10 7	1 11 3	2 0 0	2 0 5	2 0 5

Meaſured October 6, 1756; and on the 6th of November they were rather leſs.

Moſt of theſe trees were 1-8th of an inch leſs in the beginning of April 1757, than at their laſt meaſure; and had not increaſed on the 1ſt of May; but on the 1ſt of June ſtood thus.

July 3, 1757. the laſt month was very dry.

Auguſt 3, 1757. the firſt half of the laſt month was abſolutely dry and hot, and the laſt half frequent ſhowers.

September 4, 1757. from 3d Aug. to 10th very hot; the reſt of the laſt month much cooler; and the laſt half frequent ſhowers.

November.

June 1ſt, 1758, very dry ſpring.

June 30, 1758. laſt month rather dry.

July 31, 1758. laſt month very rainy, but hot.

Auguſt 29, 1758. laſt month hot, and rather moiſt.

Sept. 29. laſt month very wet and cool.

TABLE III. *Shews the Increaſe in Circumference, and in ſolid Meaſure, of each Tree in 1758.*

	Circumfer. in 1757.			Circumfer. in 1758.			Content in 1757.			Content in 1758.			The year's ſolid Increaſe of 1758.			Intereſt the Trees pay for ſtanding.	
	Feet.	Inches.	8ths of In.	Feet.	Inches.	8ths.	Cubic feet.	Quarters.	Inches.	Cubic feet.	Quarters.	Inches.	Cubic feet.	Quarters.	Inches.		Per Cent.
1. The Oak	4	11	2	5	1	2	15	0	188	16	0	260	1	0	72	or near	7
2. The Beech	1	0	4	1	2	3	0	2	216	0	3	174	0	0	390	above	36
3. The Scotch Fir	4	3	6	4	4	6	11	1	68	11	2	408	0	1	340	about	4
A Scotch Fir, not in the 2d Table, planted in 1735	4	1	4	4	4	0	10	1	296	11	2	408	1	1	112	above	12½
4. The Oak	2	10	2	2	11	6	5	0	30	5	2	216	0	2	186	above	12⅛
5. The Spaniſh Cheſnut	4	3	4	4	4	4	11	1	68	11	2	408	0	1	340	near	4
6. The Elm	1	8	4	1	10	3	1	2	408	2	0	174	0	1	198	near	21
7. The Spruce Fir	3	6	2	3	8	0	7	2	270	8	1	264	0	2	426	above	9¾
8. The Larch	1	3	1	1	5	1	0	3	392	1	1	8	0	1	48	above	28¼
9. The Willow	5	2	3	5	4	3	16	2	318	17	3	48	1	0	162	above	6½
10. The Beech	1	10	4	2	0	5	2	0	174	2	2	0	0	1	258	above	19
A Weymouth Pine	1	6	2	1	9	0	1	1	270	1	3	284	0	2	14	about	36

N. B. I meaſure the oak N° 4. as three feet round, as it wants only 1-4th of an inch of that meaſure; and the Weymouth pine as 1 foot and 6 inches, tho' it is 1-4th of an inch more.

As the Scotch fir, N° 3. has been ſickly for two years paſt; therefore I add another Scotch fir (one year younger) to ſhow the growth of that kind of tree; and the extraordinary increaſe of the Weymouth pine induced me to put that in alſo, tho' I had not meaſured it monthly.

The

The great Lord Bacon ſays, "*the improvement of the ground* "*is the moſt natural way of obtaining riches.*" What great fortunes might be raiſed, by thoſe that have property, in the vaſt heaths and downs, or fields of poor land, in this kingdom, by planting parts of them? which would alſo add great beauty to the country, and render the dwelling much more comfortable to the neighbourhood, by the ſhade in ſummer, and warmth in winter. Some parts of theſe great waſtes would produce good oak; and where the ſoil is moiſt, poplar, alder, and other aquatics, would be very profitable to the planter. The chalky ſoil ſeems the leaſt promiſing; yet beeches ſometimes thrive well upon it. The fir kind, eſpecially the Scotch fir, will grow ſurpriſingly upon poor ſandy land; but woods of fir ſhould be guarded with an out-line of birch and beech, to break the force of ſtrong winds. Birch, being the quickeſt grower, will beſt protect the young fir; but as birch, after a few years, is eaſily blown down, ſo beech will be wanted to defend the firs as they become large: for I have ſeen broad glades made by the wind through great woods of fir in Switzerland: which, perhaps, might have been prevented, at leaſt in part, by an out-line of beech.

I know ſome think, that poor land cannot produce large trees; yet the oak at Northall in Hertfordſhire, whoſe beautiful head ſpreads a circle of above 40 yards diameter, ſtands on a dry and deep ſand; and the fine cheſnuts and beeches by Mr. Naylor's grand caſtle of Herſt Monceux in Suſſex, grow in a light ſandy ſoil: and I have found, by experience, the Weymouth, Scotch, ſpruce, and ſilver firs, which I planted in a poor ſandy ſoil, are larger and finer trees, than others ſet at the ſame time in much better land. Perhaps it may require a rich clay to produce ſuch trees as the noble grove of oak in the Earl of Powis's park by Ludlow, or Lord Ducie's vaſt cheſnut at Tortworth, in Glouceſterſhire, which I meaſured 46½ feet in circumference at near 6 feet from the ground.

Although theſe ſlight obſervations are not ſo deſerving the attention of the Royal Society as I could wiſh; yet they may poſſibly be the means of producing better; and for my own part, I ſhall always eſteem it a great honour that they were communicated by Dr. Hales.

Stratton, Dec. 18, 1758. R. Marſham.